NOTICE:

1. This contains all the questions from **2014 – 2017 sorted out by topic**
2. Topic is chosen according to **'Edexcel AS Biology' and 'Edexcel A2 Biology' by Ann Fullick**
3. I did not include questions relating to experiments as they could be found in my other videos for unit 3 and 6
4. I did not include 'describe' questions.
5. I also skipped several questions from Jan and June 2014 because they were repeated in the already mentioned questions
6. Make sure you have done all your past papers before consulting this as it is purely for revision.
7. This will help your revision for **Unit 4**
8. **Lastly GOOD LUCK!!!**

TOPIC 1

1. **PROTEINS**

TOPIC 2

1. **MEMBRANE IN CELLS**

TOPIC 3

1. **ANIMAL CELLS AND ASEXUAL REPRODUCTION**
2. **STEM CELLS AND BEYOND**

TOPIC 4

1. **PLANT STRUCTURE**
2. **MODERN DRUG DEVELOPMENT**

TOPIC 5

1. **PHOTOSYNTHESIS**
2. **HOW ECOSYSTEMS WORK**
3. **GLOBAL WARMING – CAUSES, EFFECTS AND QUESTIONS**
4. **SPECIATION AND EVOLUTION**

TOPIC 6

1. **FORENSIC INVESTIGATIONS AND ANALYSIS OF DNA**
2. **MICROORGANISMS AND DISEASE**
3. **PEOPLE VERSUS PATHOGENS**

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TOPIC 1 [LIFESTYLE, HEALTH AND RISK]

1. PROTEINS

1) Describe the structure of proteins (Jan 2015)
   a) Consisting of amino acids
   b) Amino acids joined by peptide bonds
   c) Folding into two or three dimensional shape
   d) Held together by ionic bonds or hydrogen bonds or disulfide bridges
   e) Between the R groups
   f) Can be globular or fibrous proteins

TOPIC 2 [GENES AND HEALTH]

1. MEMBRANE IN CELLS

1) Explain why phospholipids are arranged in a bilayer. (Jan 2017)
   a) Fatty acids are hydrophobic
   b) Hence they face away from aqueous solution
   c) While, phosphate groups are hydrophilic
   d) Therefore, fatty acids group face each other producing a bilayer.
2) Suggest why the chlorophyll molecule has a hydrocarbon tail (Jan 2017)
   a) This part is in the membrane
   b) Tail is hydrophobic
   c) Holding chlorophyll in the correct orientation
3) Suggest how the properties of the cell membrane enable the yeast cell to form a bud. (June 2015)
   a) Membrane is fluid
   b) Fluidity allows membrane can change shape
   c) Fluidity allows membrane to fuse
   d) Proteins in the membrane play a role in cell transport

TOPIC 3 [THE VOICE OF THE GENOME]

1. ANIMAL CELLS AND ASEXUAL REPRODUCTION

1) State what is meant by the term tissue (Jan 2016)
   a) Group of same cells and with same job.
2) Explain the role of the cell cycle in yeast budding (June 2015)
   a) DNA is synthesised in S phase
   b) Mitosis is needed to produce new nucleus for the bud
   c) DNA synthesis means that the bud will have the same genes
   d) Cell division causes the bud to form
   e) Cytoplasm has to increase
   f) There needs to be synthesis of more organelles in interphase

2. STEM CELLS AND BEYOND

1) Suggest why the stem cells in the bone marrow are considered to be pluripotent. (Jan 2017)
   a) They can form many cell types

TOPIC 4 [BIODIVERSITY AND NATURAL RESOURCES]

1. PLANT STRUCTURE

1) Describe the structure of a plant cell wall (June 2017)
   a) Cellulose molecules lie parallel with each other
   b) Cellulose molecules joined by hydrogen bonds to form microfibrils
   c) Layers of microfibrils criss-cross with each other

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d) To form a matrix
e) Lignification happens

2) Compare the structure of cellulose with that of starch. (June 2017)
a) Cellulose made of β glucose and starch is made of α glucose
b) Cellulose has 1-4 glycosidic bonds and starch has 1-4 and 1-6 glycosidic bonds
c) Cellulose has alternating inverted glucoses but starch does not
d) Cellulose is a straight chain of glucose while starch has branches

3) Describe the structure of a cellulose molecule. (June 2016)
a) Cellulose is polysaccharide of β glucose
b) 1-4 glycosidic bonds
c) Every other glucose is inverted or rotated by 180°C

4) Suggest how spongy mesophyll is adapted for gas exchange. (Jan 2016)
a) The gas exchange surface is the cell wall and membrane
b) So the diffusion distance is small between air space and cytoplasm
c) The carbon dioxide can continuously enter the leaf
d) Maintains a concentration gradient between air space and cell
e) The spongy mesophyll cells are irregularly shaped and have air spaces between them
f) Large surface area to volume ratio
g) Air spaces allow fast diffusion

5) Explain why starch is a suitable molecule to be stored in the acorn. (June 2014)
a) Starch is a polysaccharide so stores energy
b) Compact so lots of energy stored
c) Insoluble
d) Does not affect osmotic potential
e) Branches in amylopectin breaks down quickly

2. MODERN DRUG DEVELOPMENT

1) Describe the methods used to test new drugs in humans (June 2016)
a) Phase I: small number of healthy individuals tested
b) Phase II: small number of patients tested
c) Phase III: large number of patients tested
d) Phase II or III require placebo or double blind trial

TOPIC 5 [ON THE WILD SIDE]

1. PHOTOSYNTHESIS

1) Describe the role of the proteins in the thylakoid membrane in the formation of ATP. (Jan 2017)
a) They act as electron carriers to pump hydrogen ions into the intermembranal space
b) ATPase channels allow hydrogen ions to pass through into stroma
c) Energy released from this movement of hydrogen ions by chemiosmosis
d) Using this energy ADP binds with P ions into ATP

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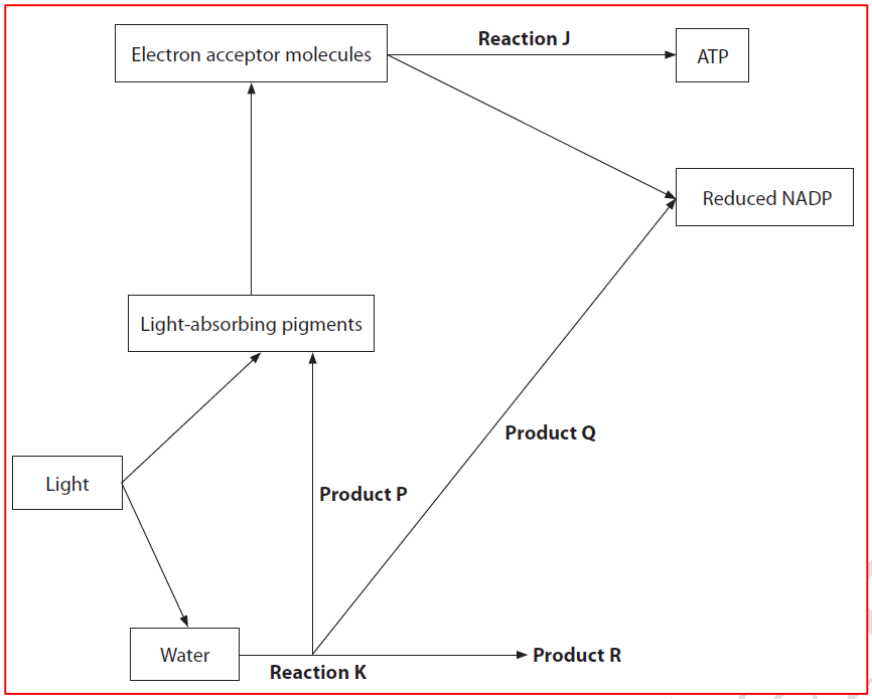
2)



a) Explain how reaction J is involved in the production of ATP in chloroplasts. (June 2017)
   i) For photophosphorylation
   ii) Electrons move along electron carrier system
   iii) H+ accumulate in the thylakoid space
   iv) H+ release energy (for phosphorylation as they move into the stroma through ATP synthase (channel)

b) Explain the roles of ATP and reduced NADP in the light-independent reaction. (June 2017)
   i) ATP and reduced NADP used in the conversion of GP into GALP
   ii) ATP provides the energy for conversion of GP into GALP
   iii) Reduced NADP provides hydrogen/ reducing power
   iv) ATP is used to regenerate RuBP

3) Describe what happens to the carbon dioxide that enters this tissue (Jan 2016)
   a) Carbon dioxide dissolves in the moisture layer
   b) Carbon dioxide diffuses into the chloroplasts
   c) Carbon dioxide binds to RuBP/ Reduction of carbon dioxide
   d) Calvin cycle
   e) To produce GP

4) Describe the roles of these ions and water molecules in photosynthesis (Jan 2016)
   a) Water for photolysis
   b) Phosphate for ATP synthesis
   c) Magnesium ions for chlorophyll
   d) Nitrate for ATP

5) Explain why the uptake of carbon dioxide and plant productivity both decrease as species richness decreased (June 2016)
   a) If there is less light energy being used there will be less photosynthesis
   b) If light-dependent reaction is reduced there will be less ATP and reduced NADP
   c) Carbon fixation, Calvin cycle and light-independent reaction will be less
   d) As a result less GALP will be made
   e) So less hexose made
   f) So less biomass made

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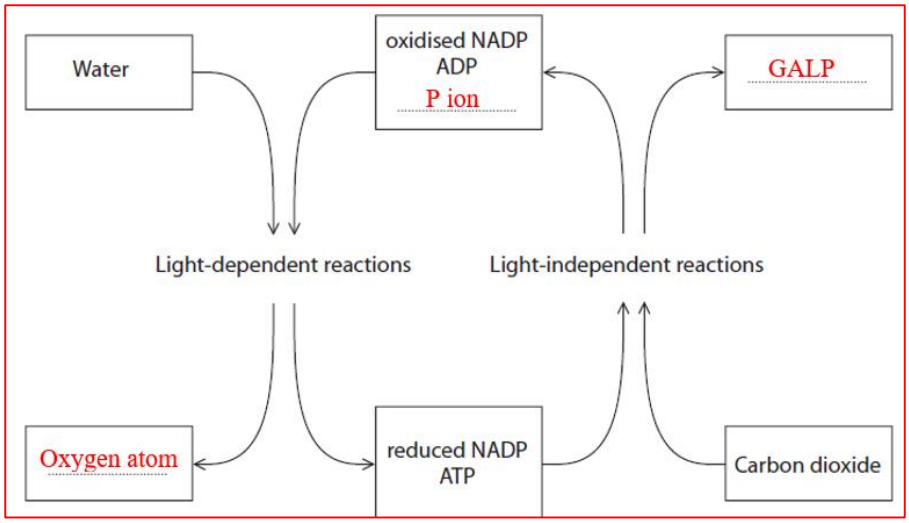
6) 

(Jan 2015)

7) Describe the roles of the thylakoid membranes in the production of ATP in the light-dependent reaction. (Jan 2015)
   a) Membranes are site of photophosphorylation and chemiosmosis
   b) Chlorophyll in the thylakoid membrane
   c) Absorption of light energy so that electrons are released from chlorophyll
   d) There are electron carriers are in the thylakoid membrane
   e) Electrons are picked up by electron carriers
   f) Resulting in hydrogen ions being moved into the thylakoid space
   g) Thylakoid membranes provide the thylakoid space
   h) ATPase in the thylakoid membrane
   i) Hydrogen ions can move diffuse through ATPase through the membrane and back into the stroma
   j) Proton movement provides the energy for the formation of ATP from ADP and phosphate ions.

8) Explain the role of light in the photosynthesis. (June 2015)
   a) Light results in excitation of electrons from chlorophyll
   b) This results in energy to generate ATP
   c) Photolysis
   d) Light is needed for breakdown of water
   e) Electrons from photolysis replace electrons lost by chlorophyll
   f) To produce hydrogen ions
   g) Both ATP and reduced NADP are needed in the light-independent reaction
   h) ATP used in production of GALP from GP

9) Describe how GALP is formed in the light-independent reaction. (June 2014)
   a) GALP formed in the Calvin cycle
   b) Carbon fixation RuBP to form glycerate 3-phosphate
   c) RUBISCO as an enzyme in carbon fixtion
   d) Formation of GALP from GP
   e) Using ATP AND reduced NADP in conversion to GALP

2. HOW ECOSYSTEMS WORK

1) Yellowstone National Park is situated in North America (Jan 2016)

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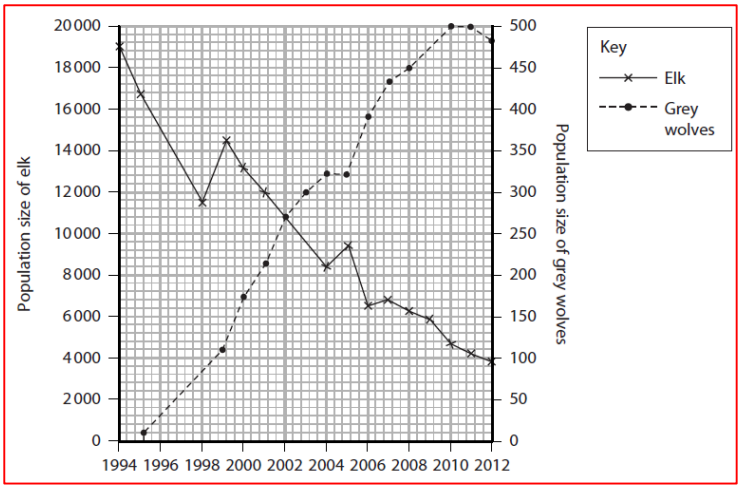
a)



i) Give explanations for these overall changes (Jan 2016)

(1) Elk decreases as they are being killed by the wolves at a faster rate than they are reproducing

(2) The number of wolves increase as they are reproducing faster than they are dying

ii) Suggest two reasons for the decrease in the population of grey wolves between 2011 and 2012 (Jan 2016)

(1) Birth rate less than death rate

(2) The elk population is too low provide enough food for the wolves

(3) Disease

(4) The wolves are being hunted

(5) Movement of wolves out of the Park

b) Suggest how the populations of other animals in Yellowstone National Park might be affected by the reintroduction of the grey wolves (Jan 2016)

i) Other animals prey of wolves might decrease in number

ii) As they are also being killed by the wolves

iii) Other carnivores might decrease in number

iv) As there are fewer elk to eat

v) The animals dependent on plants may increase

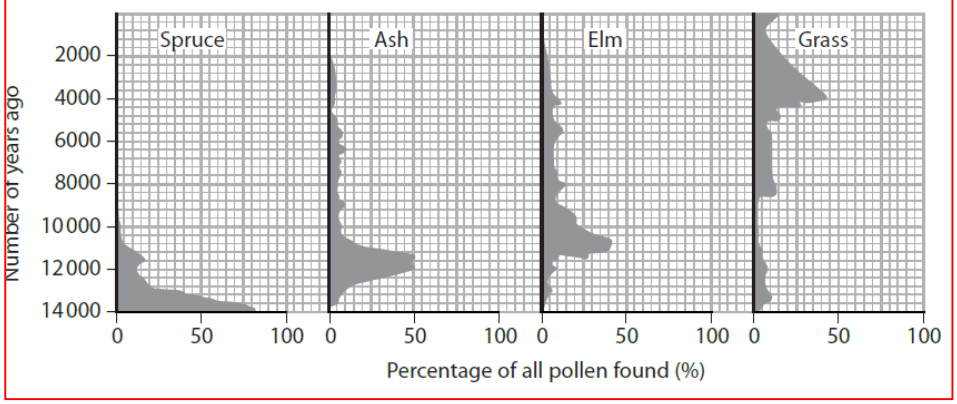
vi) Competition decreased

2)

Pollen grains present in peat bogs and lake sediment may provide evidence of climate change.

(a) In an investigation, the age of the sediment in a lake was determined. The abundance of pollen grains, from four types of plant, in the lake sediment was recorded.

The results are shown in the graph below.



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a) Explain how the information in the graph indicates that other types of plant were present around this lake. (June 2016)
   i) Abundance of plant is reflected by the percentage of pollen grains present
   ii) Pollen from all species are low
   iii) Adding the four values together does not add up to 100

b) Explain how dendrochronology may also be used to provide evidence for climate change. (June 2016)
   i) Dendrochronology is the study of tree rings
   ii) Each year a new tree ring is formed
   iii) The size of the ring reflects the growth of the tree that year
   iv) Size of ring is affected by climate
   v) Photosynthesis is affected by climate
   vi) The number of rings can be used to work out the timescale

3) A biosphere is a specialised building that can be used to study living organisms in a controlled environment. A biosphere acts as a model of their natural habitat. Microorganisms are added to the soil in the biosphere and the abiotic factors are controlled. Plants and animals are then put in the biosphere. (June 2016)

a) Distinguish between the terms environment and habitat. (June 2016)
   i) An environment includes the **biotic and abiotic factors** of a habitat
   ii) A habitat is an area where organisms live and interact **[Only abiotic]**

b) Explain why microorganisms are added to the soil in the biosphere (June 2016)
   i) For decomposition of plants and animals
   ii) To improve the quality of the soil
   iii) Releasing carbon dioxide back into atmosphere
   iv) Carbon dioxide is used in photosynthesis
   v) To recycle the nitrogen
   vi) Microbes provide food for other soil organisms

c) In one study of a biosphere, species richness decreased. It was found that the uptake of carbon dioxide and plant productivity also decreased. This was linked to a decrease in the use of the light energy in the biosphere. (June 2016)
   i) Explain the meaning of the term species richness (June 2016)
      (1) Abundance of different species in a habitat.
   ii) Suggest why a decrease in species richness would decrease the use of light energy in the biosphere (June 2016)
      (1) Fewer types of plants
      (2) Absorbing different amounts of light
      (3) Different species have different structures related to absorbing light

4) Some scientists predict that by the year 2100 mean global temperatures could increase by 12°C. Describe how scientists have made this prediction. (Jan 2015)
   a) Using computer models
   b) Using graphs
   c) Extrapolation of data

5) European great tits are predators of winter moth caterpillars. Winter moths lay eggs that hatch into caterpillars that feed on the leaves of trees in the spring season. Research has shown that European great tits now lay their eggs two weeks earlier than in 1970. (Jan 2015)

a) Suggest why this may be an advantage for European great tits (Jan 2015)
   i) There is more food available as a result of less competition from other animals that eat the caterpillars
   ii) Chicks or birds after hatching have a longer period of time to develop

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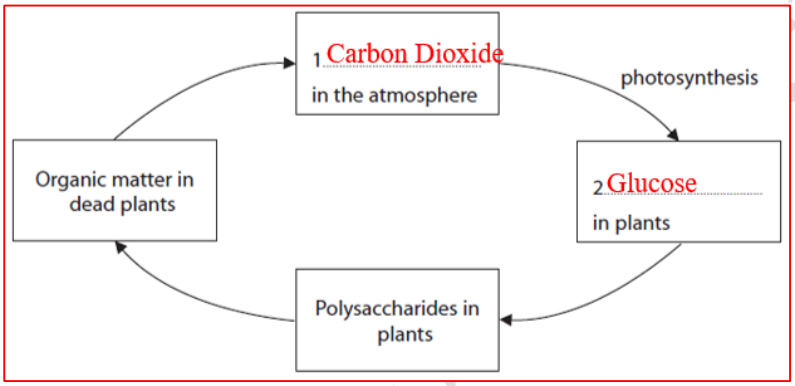
iii) Great tits have more energy to breed
iv) If there are more great tits then there will be more eggs

b) The European blackcap is another species of bird that breeds in the UK, which has also changed its behaviour in response to global warming. The majority of these birds fly long distances from Europe to North Africa. Recent studies have shown that some of these birds have now stopped making this migration and are breeding more successfully. Suggest why this change in behaviour has resulted in more successful breeding of this species. (Jan 2015)
i) Fewer birds are dying in the migration so there are more birds to breed
ii) Energy is not being used in flying so more energy to attract mate.
iii) Time is not spent migrating so more time is available to find a mate

6) Explain the meaning of the term **net primary productivity**. (Jan 2015) (Jan 2014)
a) Rate of production of biomass by plants
b) NPP = GPP – R

7) Name **two** inorganic ions and explain why each of these ions will affect the net primary productivity. (Jan 2015)
a) Calcium ions used in synthesis of calcium pectate, when cells are dividing
b) Nitrates are used in synthesis of nucleic acids, used for making chloroplasts
c) Magnesium ions needed to produce chlorophyll, chlorophyll used for photosynthesis.

8)



a) Describe how the carbon in these polysaccharides is returned to the atmosphere. (June 2015)
i) Decomposition of polysaccharides by microorganisms by hydrolysis of glycosidic bonds by enzymes
ii) Monosaccharides respired releasing carbon dioxide
iii) Plants are burnt to release carbon dioxide

9)

a) Suggest why temperature changes during this study (Jan 2016)
i) Increase in temperature due to release of heat
ii) From respiration
iii) At high temperature enzymes denature
iv) Decrease in temperature due to depletion of respiratory substrates

b) Describe the importance of nitrogen in the decomposition of organic matter (Jan 2016)
i) Nitrogen needed by bacteria

c) Suggest how the carbon:nitrogen ratio affects decomposition (Jan 2016)
i) The ratio is low the microorganisms will not have enough energy

3. GLOBAL WARMING – CAUSES, EFFECTS AND QUESTIONS

1) Explain why more ice is melting. (Jan 2017)
a) Global warming
b) Due to …
c) Global warming details …
d) Surface temperature increases

2) Describe how an increase in greenhouse gases could cause the loss of sea ice. (June 2016)

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a) UV or shorter wavelengths of light can pass through the greenhouse gases
b) Heat energy or long wavelength radiation cannot escape through greenhouse gases
c) Increasing the temperature of the earth's atmosphere and surface
d) Higher temperatures melt more of the ice
e) Less ice will refreeze

3) Suggest why the loss of sea ice could result in a decrease in the number of polar bears (June 2016)
a) Less habitat or hunting ground
b) There will be less seals to feed on
c) The bears are not building up sufficient food reserves
d) The polar bears have to swim further for food
e) There are fewer dens

4) Describe how global warming may be caused. (Jan 2015)
a) Greenhouse gases like CO2 produced by factories
b) Greenhouse gases accumulate in the upper atmosphere
c) UV light or short wave lengths pass through the greenhouse gases
d) But infra-red radiation are absorbed by the greenhouses gases
e) Mean temperature of earth's atmosphere increases

4. SPECIATION AND EVOLUTION

1) Suggest how a subspecies of giant panda evolved in the Qinling Mountains (Jan 2016)
a) Two populations are geographically isolated
b) Conditions in the two areas were different
c) Different selection pressures
d) Mutation in the DNA causing a change in phenotype
e) This phenotype had a survival advantage to the pandas
f) Resulting in change in allele frequency

2)

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White rhinoceros

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Black rhinoceros

The white rhinoceros feeds on grasses. It has a shoulder height of 1.5 m to 1.8 m and has broad flat lips.

The black rhinoceros eats the leaves of shrubs. It has a shoulder height of 1.4 m to 1.7 m and has a pointed mouth.

a) Suggest how these two species of rhinoceros evolved from their common ancestor. (June 2015)
i) Natural selection
ii) Mutation in gene coding for lip shape
iii) Mutation in gene coding for height
iv) Change in lip shape resulted in better adaptation for feeding
v) Greater height of white rhinoceros protected it in the open
vi) Alleles height passed onto offspring
vii) A change in allele frequency in gene pool
viii) The different food sources resulted in different selection pressures

ix) Reproductive isolation

b) Suggest why both species of rhinoceros can be found in the same region in Africa (June 2015)

i) They are eating different food

ii) They occupy different niches

3)

Mount St. Helens before the eruption

Surrounding area after the eruption

Surrounding area 14 years after the eruption

a) Using the information in the photographs and the graph, explain the changes in the number of different plant species in the Mount St. Helens area. (June 2015)

i) Succession

ii) Large decrease in number of plants because they are being burnt

iii) Soil improved

iv) Pioneer species growing first then low-growing plants

v) Therefore increasing the number of plants

vi) The seeds of pre-existing plants persisted

b) Suggest how further changes in the Mount St. Helens area could lead to the development of a climax community. (June 2015)

i) There will be taller plants as the soil has become deeper

ii) Taller plants outcompete the lower-growing plants

iii) Codominant species in the climax community

iv) There will be a similar number of species as before the eruption

TOPIC 6 [INFECTION, IMMUNITY AND FORENSICS]

1. FORENSIC INVESTIGATIONS AND ANALYSIS OF DNA

1.1. FORENSIC INVESTIGATION

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1)

In 1999, scientists used forensic entomology to determine the time of death of two illegally-killed black bear cubs.

When the cubs were discovered, there were adult blow flies on their bodies and blow fly eggs in their wounds.

The table below shows the timeline of the investigation and some of the observations made.

Date	Time	Stage of the investigation	Stage of insect life cycle
14th July	16:00	Cubs discovered	Eggs
14th July	16:45	Evidence collected	Eggs
14th July	17:12	50% eggs preserved in alcohol 50% eggs incubated with bear liver	Eggs
14th July	21:00	Observations of collected eggs	Eggs
15th July	07:45	Observations of collected eggs	30% eggs hatched into maggots
15th July	16:45	Observations of collected eggs	90% eggs hatched into maggots

a) Suggest why some of the eggs were preserved in alcohol. (June 2017)
   i) Prevent decomposition so can be examined at a later stage

b) Suggest why some of the blow fly eggs were incubated with bear liver (June 2017)
   i) So that the maggots could be identified
   ii) Bear liver used to provide appropriate food for the maggots

c) Use the information in the table to give the time period in which the eggs started to hatch into maggots. (June 2017)
   i) 21:00 (on 14th July) to 07:45 (on 15th July) *Check Stage of Insect life cycle*

d) Suggest why all the eggs do not hatch at the same time. (June 2017)
   i) Time that the eggs were laid
   ii) Species of blow fly
   iii) Genotypes
   iv) Metabolic rates…

e)

The eggs of three species of blow fly were found on the cubs.

The scientists knew that these species of blow fly do not lay their eggs when it is dark.

The table below shows the time taken for the eggs of these three species of blow fly to hatch into maggots, at different temperatures.

Species of blow fly	Temperature / °C	Time taken for the eggs to hatch into maggots / hours
P. regina	23.1	21.5 to 22.5
P. sericata	22.0	23.0
L. illustris	21.2	19.3 to 44.0

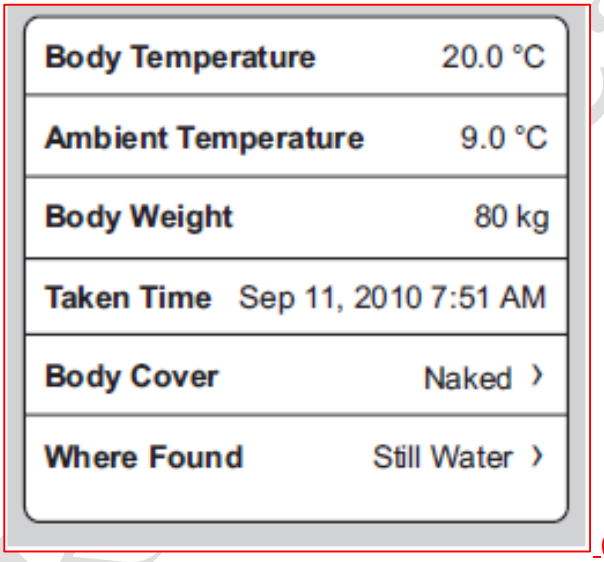
   i) Explain why the time taken for the eggs to hatch is dependent on the temperature. (June 2017)
      (1) Time taken to hatch depends on metabolic reactions
      (2) Increase in temperature increases rate of enzyme activity

(3) More collisions

ii) The scientists estimated that the time of death was in the early hours of the 14th July. Using the information provided, explain why the actual time of death could only be an estimate. (June 2017)
(1) The scientists did not know how dark it was before blow flies stop laying eggs
(2) The body temperature drops after death
(3) The ambient temperature changes between time of death and when the scientists measured it.
(4) There is a range of hatching times

iii) Explain why it is necessary to use several pieces of information to determine the time of death of an organism (June 2017)
(1) Time of death is influenced by a number of factors
(2) Gives a more accurate estimate of time of death

2) Explain how additional information about the insects and the body can be used to determine the time of death of this mammal (Jan 2016) (Jan 2014)
a) Using the life cycle stage of the insects as these will change with time after death
b) Using the state of decomposition as the changes occur in a certain order
c) Using ambient temperature as the rate of insect development
d) Because core temperature affects enzyme activity
e) Using core temperature as this changes with time after death
f) Using extent of rigor
g) Using the effect of position on body temperature
h) Combining several pieces of information to arrive at estimate

3) 
Body Temperature 20.0 °C
Ambient Temperature 9.0 °C
Body Weight 80 kg
Taken Time Sep 11, 2010 7:51 AM
Body Cover Naked
Where Found Still Water
(June 2016)

a) Explain why the information required by this app is needed to calculate the time of death of this body (June 2016)
i) Decrease in body temperature
ii) Ambient temperature affects the change in body temperature
iii) Body temperature affects other parameters used to estimate time of death
iv) Heavier body will lose heat slower
v) Because surface area is smaller and fat is a heat insulator
vi) The time of making the measurements is needed to work backwards from
vii) A naked body will lose heat faster
viii) Body will lose temperature faster in water.

4) A pathologist examined a dead body. She immediately measured the body temperature by inserting a temperature probe into the liver. The temperature probe read 34°C. She used this

reading to estimate that death had occurred eight hours previously. Explain why the pathologist inserted the temperature probe into the liver immediately. (Jan 2015)

a) Probe inserted in to liver to record core temperature
b) The closer to death the temperature taken the more accurate the estimate of the time of death
c) Core temperature dropping with time after death
d) Heat loss from body
e) A change in conditions will affect rate of temperature drop

1.2. ANALYSIS OF DNA

1) Describe the differences in the DNA that might be seen using gel electrophoresis (June 2017)
   a) Different pattern of bands
   b) Different position of bands
   c) Different number of bands
   d) Different size of bands
2) Suggest how this DNA could be prepared for analysis by gel electrophoresis (Jan 2016)
   a) Extracting the DNA from the faeces
   b) Use of polymerase chain reaction
   c) To amplify DNA
   d) Use of restriction enzymes
   e) To produce DNA fragments
3) Explain how the results of this DNA analysis can be used to estimate the number of giant pandas in the wild (Jan 2016)
   a) Comparing the DNA banding patterns
   b) Number of bands
   c) Number of different sets of bands
4) Name the type of reaction that joins the monomers together in the formation of a polypeptide (Jan 2016)
   a) Condensation
5) Explain the role of the polymerase chain reaction (PCR) in the analysis of the DNA of these bears. (Jan 2017)
   a) PCR increases the number of copies of the DNA
   b) For gel electrophoresis
6) Explain how protein and copies of the poliovirus RNA are synthesized from the poliovirus RNA. (June 2017)
   a) Proteins:
      i) Poliovirus RNA attaches to ribosomes
      ii) It acts as a template strand for translation
      iii) tRNA binds to a single amino acid
      iv) tRNA forms complementary base pairs with RNA strand
      v) The amino acids are lined up together and form peptide bonds with each other
      vi) The ribosome moves along the RNA strand to make a longer peptide chain.
   b) Poliovirus RNA
      i) RNA nucleotides line up along the poliovirus RNA to make the template RNA
      ii) The template RNA lines up the nucleotides to make the poliovirus RNA
      iii) The nucleotides join by phosphodieseter bond.
7) Suggest how blood and bone marrow samples could be used to diagnose myeloma. (Jan 2017)
   a) Blood sample will have lower number of blood cells
   b) Bone marrow sample will have fewer stem cells
8) Suggest why genetic test can be used to diagnose myeloma (Jan 2017)
   a) Genetic tests can detect gene mutation
   b) Myeloma is caused by a mutation
   c) In genes that control rate of cell division (Recall: proto-oncogens)

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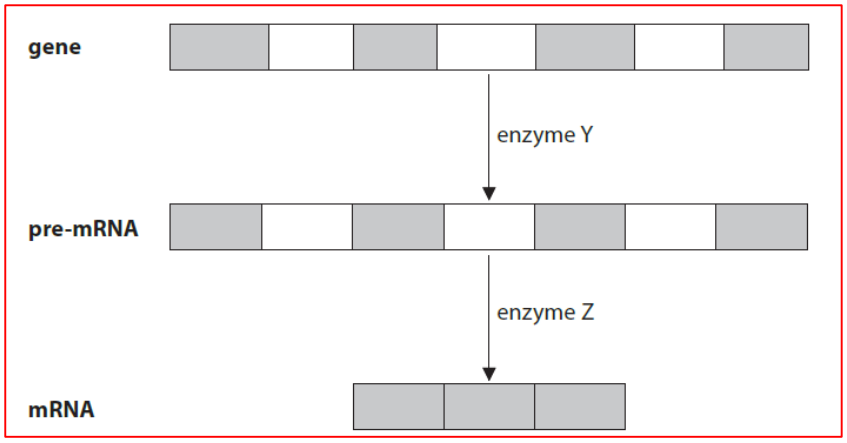
9) 

(June 2016)

a) Name the enzyme Y (June 2016)
   i) RNA Ligase
b) State the role of enzyme Z (June 2016)
   i) Remove the introns / join the exons
c) Name the parts of the pre-mRNA molecule, represented by the shaded areas in the diagram. (June 2016)
   i) Exons
d) 'A gene may be defined as a length of DNA coding for **one polypeptide chain'**. Using the information in the diagram, explain why this definition does not apply to this gene. (June 2016)
   i) Not all of the DNA codes for the polypeptide chain
   ii) Due to post-transcriptional changes
   iii) By the removal of introns
   iv) Different mRNAs can be produced
   v) Each mRNA would result in a different amino acid sequence
e) Describe how the **polypeptide chain is synthesised from the mRNA** (June 2016)
   i) By translation
   ii) mRNA attaches to a ribosome
   iii) One tRNA brings one amino acid to the mRNA
   iv) Binding of codon on mRNA to anticodon on tRNA
   v) Formation of peptide bonds between adjacent amino acids
   vi) The polypeptide detaches from the RNA

10) A group of scientists recently extracted DNA from a polar bear footprint left in the snow. They found polar bear DNA and seal DNA. (June 2016)

a) Suggest why a footprint can be used as a source of DNA (June 2016)
   i) There are skin or blood cells in the footprint
b) Suggest two advantages of using DNA obtained from a footprint, rather than collecting DNA directly from a polar bear. (June 2016)
   i) Less intrusive to the bear
   ii) Less likelihood of infection
   iii) Being safer for the scientist
   iv) Cheaper
   v) Easier to collect the sample
c) Suggest how the scientists could conclude that the DNA they identified came from both the polar bear and a seal (June 2016)
   i) Comparing number bands
   ii) Comparing samples to both polar bears and the seals

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iii) The polar bears and seals would have unique profiles but the sample would be a combination
iv) Checking bands against those expected for other animals

11) Using your knowledge of gel electrophoresis in the analysis of DNA, suggest how gel electrophoresis could be used to analyze the protein. (Jan 2015)
a) Protein loaded onto the gel
b) An electric current is applied
c) Gel electrophoresis separates the protein fragments
d) Looking at number of protein bands
e) Looking at size of protein bands
f) Looking at position of protein bands;

12) Explain the importance of the sequence of bases in a gene. (Jan 2014)
a) Triplet coding system
b) Sequence of bases determines order of amino acids
c) Importance of primary structure in folding of protein
d) Start sequences
e) Stop codons

13) The cochlea in a chicken's inner ear is lined with hair cells that can detect different frequencies of sound. The frequency detected depends on the type of BK channel protein present in the cell membrane.

One report suggests that there are 48 different BK channel proteins in these hair cells.

The *cSlo* gene codes for all of these BK channel proteins.

Explain how one *cSlo* gene can give rise to different BK channel proteins in these hair cells. (Jan 2014)
a) Transcription
b) Post-transcriptional modification of pre-mRNA
c) Spliceosomes
d) Removal of introns
e) Exons are arranged in different combinations
f) The (m)RNAs are different
g) Translation
h) Different primary structure
i) This results in different bonds

2. MICROORGANISMS AND DISEASE

1) Bacteria VS Virus. (Jan 2017)
a) Bacteria have cytoplasm and ribosomes while viruses don't
b) Viruses have a protein coat
c) Bacteria and Viruses have nucleic acids

2) Describe the structure of a virus (June 2016)
a) Contains either RNA or DNA nucleic acid
b) Contains a protein coat or capsids
c) Envelope may be present
d) Enzymes may be present
e) Contains receptors on surface

3) Describe the role of plasma cells in the immune response. (Jan 2017)
a) To produce antibodies
b) Antibodies cause agglutination of pathogens reducing their effectiveness

4) Suggest why myeloma can lead to bleeding problems, an increase in infections and anemia. (Jan 2017)

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Bone marrow contains pluripotent stem cells that result in the production of platelets, white blood cells and red blood cells.

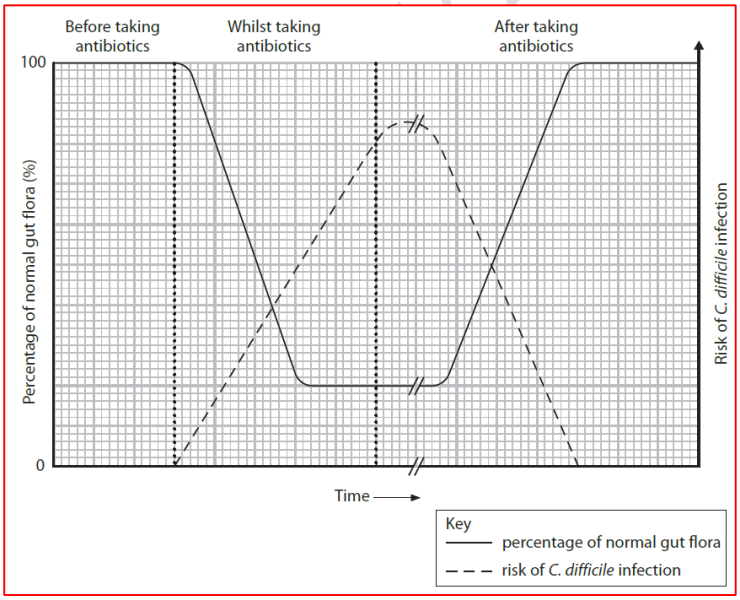
Myeloma is a cancer that affects bone marrow. As a result, abnormal plasma cells reduce the number of stem cells in the bone marrow.

Myeloma can lead to bleeding problems, an increase in infections and anaemia. Anaemia results in tiredness, weakness and breathing problems.

Myeloma can be diagnosed using blood tests, genetic tests and by looking at samples of blood and bone marrow under a microscope.

a) Bleeding problems:
   i) Fewer platelets affects clotting
   ii) If blood does not clot then there will be bleeding problems
   iii) If blood clot does not form then pathogens can enter wound
b) Infections:
   i) Less white blood cells to phagocytose pathogen
   ii) A lack of T helper cells means that T killer cells cannot be activated (Recall: T helper cells release Cytokines to stimulate T killer cells replication)
   iii) No T Killer cells will result in host-infected cell not being destroyed
   iv) Lack of plasma cells will result in no antibody production
c) Anaemia:
   i) Lack of red blood cells means less oxygen
   ii) Less respiration results in less ATP

5) Explain how gut flora protect the body from infection (Jan 2017)
   a) Competition for space with bacteria
   b) Production of anti-microbial chemicals
6) Using the information in the graph, explain why people taking antibiotics are at risk of developing C.difficile infection. (Jan 2017)



   a) Taking antibiotics reduces the number of gut flora
   b) Less competition with the C.difficile so they have more space and nutrients hence proliferate
7) Explain the meaning of the term **artificial active immunity.** (June 2017)

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a) Artificially made by inhibiting the disease causing gene in the pathogen to present antigens for the immune system.
b) Active stimulation of primary immune response
c) Immunity resulting in memory cells

8) Explain why vaccines against polio contain inactive forms of all three strains of poliovirus. (June 2017)
a) Virus needs to be inactivated so that it cannot cause disease
b) There are three different antigens
c) So all three types of antibody have to be produced
d) Therefore all three types of memory cells have to be produced
e) The B cells recognize the antigen presented on the pathogen and divide by mitosis, some of the population differentiates into plasma cells while other become B memory cells.
f) The vaccine will provide a long term immunity to all three strains
g) Upon infection, more antibodies produced and quicker.

9) Explain the importance of mitosis in the proliferation of activated T killer cells. (June 2017)
a) To increase the number of T killer cells
b) So that T killer cells are antigen-specific
c) So that host infected cells can be destroyed faster

10) Explain how virus-infected host cells are destroyed by T killer cells. (June 2017)
a) Release of chemicals from T killer cells
b) Enzymes cause the lysis of host-infected cells

11) Describe the role of macrophages in the activation of T killer cells (June 2017)
a) Macrophages present antigen to T helper cells
b) The macrophages engulf the pathogen by phagocytosis
c) Chemicals with macrophage break apart the pathogen and release the antigens
d) This forms the MHC (Major Histocompatibility Complex) for binding of specific immune cells hence becomes the APC (Antigen Presenting Cell)
e) The T helper cells are needed to activate T killer cells

12) Describe the role of macrophages in the destruction of viruses (June 2017)
a) Phagocytosis of virus
b) Destruction of virus with enzymes
c) Enzymes breakdown protein coat

13) Drugs are being developed that contain either interferon or chemicals that interfere with viral replication. Suggest how these drugs could prevent the development of EVD in humans. (June 2016)
a) Interferon would prevent attachment of virus to host cell
b) Therefore virus particle can be destroyed by the immune system and engulfed by macrophages
c) Without a host cell the virus cannot replicate
d) Chemicals only
i) Chemicals could inhibit viral enzymes
ii) Chemicals could prevent nucleic acid synthesis
iii) Chemicals could prevent protein synthesis
iv) No new particles would be made

14)

Class of antibody	Antibody concentration in human colostrum / mg cm^{-3}	Antibody concentration in bovine colostrum / mg cm^{-3}
IgA	17.4	3.9
IgG	0.4	47.6
IgG2	0.0	2.9

(June 2016)

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a) Explain why colostrum increases the survival chance of a calf (June 2016)
   i) Calf is protected against pathogens
   ii) Calf's immune system takes time to develop
   iii) Opsonisation so that macrophages can phagocytize the pathogen more easily
   iv) Agglutination to prevent pathogens from infecting cells

15) Immunoassays use antibodies to identify the protein fragments. Suggest why antibodies are suitable molecules for identifying protein fragments. (Jan 2015)
   a) Antibodies bind to antigen
   b) An antibody will only bind to one antigen
   c) Antibodies can be labelled to visualise the antigen

16) Suggest why the mRNA molecules do not always correspond to the proteins in the cell. (Jan 2015)
   a) Cell not actively synthesising the protein
   b) mRNA for that protein is no longer present
   c) Post-transcriptional modification of mRNA
   d) Pre-mRNA will be different from post-mRNA
   e) Protein has been secreted from cell
   f) So only mRNA present
   g) A mistake during translation so different amino acid inserted

17) Describe the structure of a virus (June 2015)
   a) Contains genetic material.
   b) Single-stranded or double-stranded nucleic acid
   c) Capsid / protein coat
   d) An envelope may be present
   e) Spikes
   f) Some viruses contains reverse transcriptase

18) Explain why there is a delay, following this infection, before the number of virus particles increases. (June 2015)
   a) Synthesis of viral components
   b) Assembly of virus

19) Describe the role of interferon (June 2015)
   a) Interferons inhibit viral replication
   b) Interferon prevents attachment of virus to other host cells so that other cells cannot be infected when they burst out of infected cell

20) Explain why there is a delay before the level of antibodies starts to rise. (June 2015)
   a) Humoral response
   b) Antigen has to attach to B cells
   c) T helper cells are needed in activation of B cells
   d) T helper cells have to be activated by macrophages present antigen to them before they can activate B cells
   e) Cloning of B cells has to take place
   f) B cells differentiate into plasma cells
   g) Antibody production by plasma cells

21) Explain the meaning of the term infection (June 2015)
   a) Pathogen being inside tissues

22) Explain how gut flora protect the body from infection. (June 2015)
   a) Gut flora prevent growth of bacteria
   b) Competition for space
   c) Release of chemicals

23) Explain the meaning of the term antibiotics (June 2015)
   a) Substance produced by microorganisms that kills other microorganisms.

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24) Describe the role of T helper cells in the immune response (Jan 2014)
   a) Cytokines from T helper cells
   b) Involvement in humoral response
   c) Antibody production by plasma cells
   d) Involvement in cell mediated response
   e) T killer cells destroying infected host cells

3. PEOPLE VERSUS PATHOGENS

1) Describe the sequence of symptoms that results in the death of a person infected with TB. (Jan 2017)
   a) Breathing problems
   b) Coughing up blood
   c) TB causes suppression of immune system
   d) Secondary disease causes death
2) Explain how infection with HIV results in the T helper cells being destroyed. (Jan 2017)
   a) HIV DNA invades the DNA of the T helper cell
   b) Many HIV particles produced within cells
   c) T helper cells lysis to release the HIV particles within to infect other T cells
3) Describe two ways in which codes of practice relating to antibiotic prescription could help to reduce this evolutionary race. (Jan 2017)
   a) Only prescribing antibiotics for bacterial infections, not for viral infections
   b) Prescribing an appropriate antibiotic
   c) Prescribing correct dosage
   d) Education of patients to follow instructions for taking antibiotics exactly
   e) Reduction in the prophylactic use of antibiotics
4) State two ways in which hospital codes of practice have influenced the prescription of antibiotics. (Jan 2016)
   a) Using only when necessary
   b) Patients should finish the course
   c) Using narrow spectrum antibiotics
   d) Not using just in case infection occurs
   e) Using appropriate antibiotic for the infection
   f) Rotating the antibiotics
5) Describe **three** procedures, other than hand washing, that hospitals use to reduce the spread of infection. (Jan 2015) (June 2015)
   a) Screening patients and isolating infected patients
   b) Washing bedding frequently
   c) Removal of jewellery and removal of outdoor clothing
   d) Wearing protective clothing
   e) Appropriate disposal of dressings
   f) Sterilisation of bedding and surfaces
6) State two ways that hospitals can reduce the spread of infections caused by viruses (Jan 2014)
   a) use of hand washes
   b) Reduce proximity of patients to each other
   c) Suitable dress eg masks, no jewellery
   d) Suitable washing of bedding
   e) Correct disposal of dressings
   f) Screening of patients
   g) Sterilizing equipment

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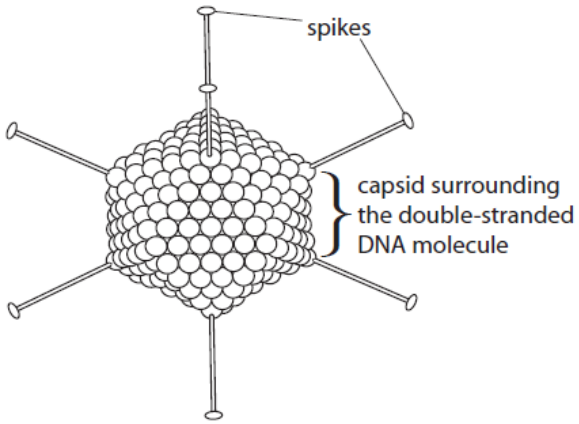
2) 7 Adenoviruses can cause infections of the respiratory tract.

The diagram below shows the structure of an adenovirus.



(Jan 2015)

a) Using the information in the diagram and your own knowledge, describe how the structure of the adenovirus is different from the structure of the Human Immunodeficiency Virus (HIV). (Jan 2015)

Adenoviruses	HIV
DNA	RNA
Double stranded DNA	Single stranded RNA
One molecule of DNA	Two strands of RNA
No envelope	Envelope
Does not contain reverse transcriptase	HIV has reverse transcriptase
Spikes	gp 120

3) Describe the role of T killer cells in the immune response to a viral infection (Jan 2015)

a) Destruction of virus-infected host cells
b) By chemicals released from T killer cells
c) Virus are released from cells
d) Antibodies can now bind to virus
e) The virus can now be phagocytosed by macrophages
f) Memory T killer cells form for secondary immune response

❖ **EXPERIMENTS**

1)

Magnification ×0.05

A gardener planted a mixture of plants around a rhododendron bush. Not all of these plants grew.

The gardener was told that rhododendron bushes release poisons into the soil. These poisons can kill some plants.

The gardener wanted to know how near to the rhododendron bush plants could be grown.

a) Describe an investigation to determine how near to the rhododendron bush the gardener could grow new plants. (Jan 2017)

i) Planting several plants of same species

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ii) Planting several different species
iii) Planting at different distances
iv) Leaving plants to grow for a period of time
v) Height and length measurement of plant
vi) Closest distance that plants grow is the closest distance that they can be planted

b) Describe how water availability and light could be measured (Jan 2017)
   i) Water Avaliability
      (1) Take a soil sample
      (2) Heat the soil to dry it and then record the mass loss
   ii) Light
      (1) Light meter
      (2) Held at ground level

c) Explain how water availability and light could be affected by the rhododendron bush. (Jan 2017)
   i) Less water for absorption
   ii) Less light for photosynthesis

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